

**Method for marking a laminated film material**

sub 51 This is a continuation of International Application No. PCT/EP99/05175, filed July, 22.

The invention relates to a method for marking a laminated film as well as a laminated film for packaging purposes.

10 The use of laminated films as backing foils for blister packs is well-known in packaging technology. Such laminated films consist of a metallic base, such as aluminium, affixed to a plastic film, which is printed on the upper side and/or the side facing the metal foil, and a plastic film material on the underside that can be welded to a plastic container. Such laminated films are often also marked on the upper side with a variety of information, such as the expiry date, a lot number, and other marks identifying the contents of the pack. If the blister pack is to undergo various other process steps after sealing, such as sterilization by autoclaving, because the contents of the pack are for use in the field of medicine, for example, then it must be guaranteed that the marking on the upper side can withstand such treatment.

20 A thermal transfer printing process for marking blister packs which are subsequently exposed to sterilization is known, for example, from EP-0 646.471. The result of the marking, however, is not particularly satisfying, because it is too full of contrasts and cannot therefore be optimally coordinated with the packaging design. Furthermore, the process entails the consumption of a large quantity of material. Moreover, using present technology, the marking still has to be carried out on rolled material, i.e. on film which is generally wound around a roller, because it is not possible to mark containers that are already sealed.

30 The invention addresses the problem of marking the upper side of a laminated film, especially for blister packs, in such a manner that the marking withstands subsequent process steps such as sterilization of the packaging and produces a result which is optically suitable. Furthermore,

the marking process should take place on-line in a packaging plant and be characterized by minimal consumption of materials.

5 The use of laser enables the upper side of the film material to be furnished with laser inscribed marks which prove resistant to subsequent process steps, such as sterilization in particular, and retain their characteristics. As a result of the laser treatment, either the upper plastic film is changed thermally in such a manner that a visible colour change occurs, or the part of the surface treated with the laser beam is removed to produce the desired lettering. In the case of the latter subtractive procedure, the coloured top layer of the film is removed down to the metal  
10 substrate, which also serves as a buffer against the laser treatment, thus eliminating the risk of perforation. If a plastic is selected whose colour contrasts sharply with the metallic colour, then the film acquires a clearly visible marking which can be integrated much better into the visual identity of the packaging design than is possible with black-and-white printing. Because the underlying metal layer does not show any change when the packaging is treated in an  
15 autoclave, there is no impairment of the marking after such treatment. If a colour change of the upper plastic layer is to be achieved by laser, then generally a plastic film is used containing pigments whose colour changes on laser treatment. In every case, laser permits the marking of containers that are already filled and sealed, because printing takes place on a non-contact basis with a relatively large distance between the marker and the sealing film, so that a smooth  
20 surface is not required.

Further details and advantages of the invention are apparent from the following description and drawings. The drawings show:

- 25 Fig. 1 a schematic diagram of a laser marking unit and the printing of a film according to the invention;
- Fig. 2 a diagram of the integration of two laser marking units in a packaging plant;

Fig. 3 a diagram of blister strips arranged alongside each other;

Fig. 4 a schematic diagram of the control system for several laser marking units.

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Laser marking unit 1 is designed for the marking of a laminated film, especially for a blister pack. Such a laminated film comprises a metallic substrate, typically of aluminium, affixed to a plastic film which is printed on the upper side and/or on the side facing the metal foil, and a plastic film material on the underside that can be welded to a plastic container. As a result of the laser treatment in the laser marking process, either the upper plastic film is changed thermally in such a manner that a visible colour change occurs, or the part of the surface treated with the laser beam is removed to produce the desired lettering. Laser marking unit 1 preferably comprises a laser 2, deflecting mirrors 3 and a flat field lens 4. High frequency-excited sealed-off CO<sub>2</sub> lasers without an external gas supply and having a wavelength of 10.6 µm are preferably used as laser source 2 for the subtractive marking procedure. Generally it can be assumed that the gas fill has a life of about 20000 operating hours. Because the laser is HF-pumped, there is no need for pumping flashlamps, such as are used for example with solid state lasers. For this reason, the costs are confined to the cost of energy consumption. For laser marking by means of a colour change in the upper plastic film, Nd:YAG laser is preferably used.

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Laser beam 5 is expediently deflected by two rotating galvanometer mirrors 3. These operate in a closed loop with active stabilization of temperature. Because the mirrors 3 have only a very low mass which is moved, a high deflection rate and accurate path precision are possible. After deflection, the beam 5 is focused through a flat field lens 4 onto the operating level 6. Overall, as a result of this calibrated lens and mirror system 3,4, the focus point of the laser 2 is moved in the operating plane 6. The flat field lens 4 preferably has a focal length of 200 mm, providing a sufficiently large working distance. A distortion of the laser beam 5 is excluded by virtue of the axial shift arrangement of the rotating galvanometer mirrors 3. The mirrors 3 are controlled by a card located in the computer. Furthermore, an integrated beam expander provides for a small diameter of the focus point with good depth of focus in the TEM<sub>00</sub>-Mode. A small diameter of the

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focus point is important for the quality of the marking, especially if a large working field is envisaged. A favourable diameter of the focus point is 320 µm.

Because the writing head of the laser 2, comprising the deflecting mirrors 3 and the flat field lens, is 4.200 mm from the film surface 6 which is to be marked, a screening of the work space is necessary for safety reasons to protect against any interposition during the marking procedure. Owing to the wavelength of the laser 2 which is used, a plexiglass enclosure can be used for this purpose. This offers the advantage that the marking procedure can be inspected. In addition, the design includes an interruption device 8 for the laser beam 5, which is under electronic control and serves to interrupt the laser beam. It is activated when, for example, the protective doors of the enclosure are opened.

Laser marking unit 1 is preferably integrated into a packaging plant, so that the marking of the film is fully automatic, taking place directly on-line, ideally after the packaging container is sealed. Fig. 2 shows five production lines 7 of a packaging plant especially for contact lenses continually transporting the tool carriers 9 illustrated in Fig. 3, each of which is loaded with a blister strip 10. The blister strips 10 comprise five blister packs 11 arranged one behind the other, which are connected to one another by a film strip 12 corresponding in shape to the outline of the upper side of the blister packs 11, because film strip 12 is welded to the individual blister packs 11 after these have been filled with the object of the packaging, preferably a contact lens. To mark the upper side of film 12 of the blister strips 10, a stopper bar 13 fitted with sensors is envisaged, causing carrier 9 with the blister strips 10 to stop briefly so that they can be marked in a firm marking position by laser 2. Because the deflection of the laser beam 5 is not sufficient for the five lines 7 envisaged in the preferred embodiment and a shifting of laser marking unit 1 would be too complicated, it is intended that two laser marking units 1 and 100 should advantageously be integrated into the packaging plant wherein unit 1 provides marking for lines 1, 2 and 3 and unit 100 for lines 3, 4 and 5.

As shown in Fig. 4, the requisite marking data are fed by a process control system to the packaging plant and the laser marking units 1 and 100, the datasets possibly being different for

each line 7. Within a single line 7, the dataset remains the same until new datasets are transmitted by the process control system. The marking of line 3 is carried out by the laser unit 1 or 100 which is the first to become free.

- 5 The waste which occurs during the marking procedure is advantageously discharged by an exhaust air system which is not described in further detail here.

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The marking results obtained using a CO<sub>2</sub>-laser show that the marking of the film is characterized by a very high quality of lettering and resistance. The text is clearly legible and is distinguished by a high degree of resolution. The top coloured layer of the film is removed as far as the metal substrate, wherein it has been shown that, when aluminium is used as the substrate, this provides a good buffer for the laser treatment and no perforations occur during the process. Overall, the marking is of pleasing appearance and matches the packaging design well. Because the process is carried out on a non-contact basis with a relatively large distance between marker and sealing film, containers that are already filled and sealed can be marked without any problem in respect of clarity and resolution of the lettering. Moreover, the integration of a marking unit within a packaging plant has the advantage that the production process can be substantially more flexible. In addition, it has been shown that, after sterilization, the marking remains clearly legible and is not subject to changes.

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